

BY HAND

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9/14/99

September 14, 1999

Office of Special Nutritionals (HFS-450)
Center for Food Safety and Applied Nutrition
Food and Drug Administration
200 C St., S.W.
Washington, DC 20204

Dear Sir or Madam:

This notification is being filed pursuant to section 403(r)(6) of the Federal Food, Drug and Cosmetic Act ("FFDCA"), 21 U.S.C. § 343(r)(6), and in accordance with the requirements of 21 C.F.R. § 101.93. China Shanxi ZhengZhong Group Co., Ltd., 130 Shuangta West Street (Jinguang Building), Taiyuan, Shanxi 030012, China, plans to market a dietary supplement bearing the following statements on the label and/or in the labeling:

Name of supplement:	Chinese Joint Complex
Dietary ingredients:	Phellodendron Bark (Huang-Bai)
	Prunus armeniaca (seed)
	Stemona sessilifolia (root)
	Job's Tears (seed)
	Pinellia (Ban-Xia) (rhizome)
	Forsythia (Lian-Qiao) (fruit)
	Stephania Root (Fang-Ji)
	Tetrapanax papyriferus (medulla)
	Siegesbeckia glabrescens (herb)
	Shrubby Sophora (Ku-Shen) (root)
	Tripterygium wilfordii (root)
	Glycyrrhiza glabra (root)

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Structure/function
statements:

1. **For joint health**—This statement is the subject of Chinese Joint Complex, and the Chinese Joint Complex ingredients Job's Tears (seed), Stephania Root (Fang-Ji), Siegesbeckia glabrescens (herb), and Tripterygium wilfordii (root).
2. **Helps maintain healthy, mobile joint function and connective tissue health**—This statement is the subject of Chinese Joint Complex, and the Chinese Joint Complex ingredients Job's Tears (seed), Stephania Root (Fang-Ji), Siegesbeckia glabrescens (herb), and Tripterygium wilfordii (root).
3. **Promotes joint flexibility**—This statement is the subject of Chinese Joint Complex, and the Chinese Joint Complex ingredients Job's Tears (seed), Stephania Root (Fang-Ji), Siegesbeckia glabrescens (herb), and Tripterygium wilfordii (root).
4. **Controls swelling**— This statement is the subject of Chinese Joint Complex, and the Chinese Joint Complex ingredients Job's Tears (seed), Stephania Root (Fang-Ji), Forsythia (Lian-Qiao) (fruit), Tetrapanax papyriferus (medulla), Glycyrrhiza glabra (root), and Tripterygium wilfordii (root).

Please send any correspondence concerning this notification to our counsel in the United States at the following address:

Kathleen M. Sanzo
Morgan, Lewis & Bockius LLC
1800 M Street, N.W.
Washington, D.C. 20036

Summary of Substantiation:

The claims "for joint health," "helps maintain healthy, mobile joint function and connective tissue health," "promotes joint flexibility," and "controls swelling" for Chinese Joint Complex, are based on, and supported by, reference to authoritative scientific literature and the long marketing history for Chinese Joint Complex in the People's Republic of China.

The Pharmacopoeia of the People's Republic of China, which is approved by the Ministry of Public Health of the People's Republic of China, states the following actions and indications for the component ingredients of Chinese Joint Complex (see attached):

- Job's Tears (seed) (listed as semen coicis): Action—to alleviate arthritis; Indications—arthritis with contracture of joints;
- Stephania Root (Fang-Ji) (listed as radix stephaniae tetrandrae): Action—to relieve rheumatic conditions; Indications—edema with rheumatic arthritis;
- Siegesbeckia glabrescens (herb) (listed as herba siegesbeckiae): Action—to relieve rheumatic conditions, to improve the motility of joints, etc.; Indications—rheumatic arthralgia with aching and weakness of the loins and knees, and numbness of the limbs;

In addition, The Pharmacology of Chinese Herbs, Second Edition, a highly regarded resource for scientists interested in herbal medicine, states the following actions and indications for the component ingredients of Chinese Joint Complex (see attached):

- Stephania Root (Fang-Ji): Actions—anti-inflammatory and anti-hypersensitivity; Therapeutic Uses—in the treatment of arthritis;
- Glycyrrhiza glabra (root): Actions—anti-inflammation;
- Forsythia (Lian-Qiao) (fruit) (listed as fructus forsythiae): Action—anti-inflammatory properties;
- Tripterygium wilfordii (root): Actions—anti-inflammatory effect, inhibits proliferation of peripheral blood mononuclear cells of rheumatic arthritis patients, improvement of stiffness, walking, and hand grasping strength, and reduction of inflammation index;
- Siegesbeckia glabrescens (herb): Uses—arthritis and rheumatism; and
- Job's Tears (seed) (listed as Coix lacryma-jobi L.): Uses—antirheumatic, arthritis, and inflammation.

The findings of numerous *in vitro*, animal, and human studies involving the Chinese Joint Complex ingredients also support the above claims:

- Forsythia (Lian-Qiao) (fruit) (also referred to as *Forsythia suspensa* Vahl) has demonstrated an anti-inflammatory effect in mice;^{1/}
- Job's Tears (seed) (also referred to as *Coix lachryma-jobi* var.) has demonstrated an anti-inflammatory effect in rats;^{2/}
- Stephania Root (Fang-Ji) (also referred to as *Stephania tetrandrae* S. Moore) has demonstrated an anti-inflammatory effect in rats;^{3/}
- *Tetrapanax papyriferus* (medulla) (also referred to as *Tetrapanax papyriferum*) has demonstrated an anti-inflammatory effect in rats;^{4/} and

1/ Ozaki Y *et. al.*, *Antiinflammatory Effect of Forsythia Suspensa Vahl and Its Active Fraction*, BIOL-PHARM-BULL Aug; 20(8): 861-4 (1997).

2/ Otsuka H *et. al.*, *Anti-inflammatory Activity of Benzoxazinoids From Roots of Coix Lachryma-jobi Var. Ma-yeun*, J NAT PROD Jan-Feb; 51(1): 74-9 (1988).

3/ Kobayashi S. *et. al.*, *Inhibitory Effects of Tetrandrine on Angiogenesis in Adjuvant-induced Chronic Inflammation and Tube Formation of Vascular Endothelial Cells*, BIOL PHARM BULL Apr;21(4):346-9 (1998).

4/ Sugishita E. *et. al.*, *Studies on the Mechanism of Anti-inflammatory Activities of Papyriogenin A and Papyriogenin C*, J PHARMACOBIOLOGY May;6(5):287-94 (1983);
Sugishita E. *et. al.*, *Structure-activity Studies of Some Oleanane Triterpenoid Glycosides and Their Related Compounds From the Leaves of Tetrapanax Papyriferum on Anti-inflammatory Activities*, J PHARMACOBIOLOGY Jun;5(6):379-87 (1982).

- Tripterygium wilfordii (root) has demonstrated through numerous *in vitro*,^{5/} animal,^{6/} and human^{7/} studies to be an effective treatment for rheumatoid arthritis and its symptoms.

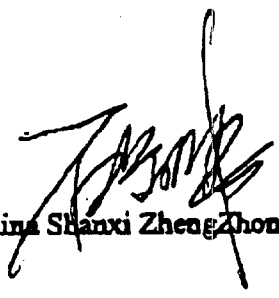
In addition, Chinese Joint Complex has been used by over 100,000 individuals and for over 20 years in China for the improvement of joint health, maintenance of healthy, mobile joint function and connective tissue health, and control of swelling.

Therefore, the proposed claims "for joint health," "helps maintain healthy, mobile joint function and connective tissue health," "promotes joint flexibility," and "controls swelling" are proper and supportable for Chinese Joint Complex.

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- 5/ Chou CT et. al., *The Inhibitory Effect of Common Traditional Anti-Rheumatic Herb Formulas on Prostaglandin E and Interleukin 2 In Vitro: A Comparative Study With Tripterygium Wilfordii*, J ETHNOPHARMACOL Sep;62(2):167-71 (1998).
- 6/ See e.g., Asano K. et. al., *Suppressive Effects of Tripterygium Wilfordii Hook F., A Traditional Chinese Medicine, On Collagen Arthritis In Mice*, IMMUNOPHARMACOLOGY May; 39(2): 117-26 (1998); Gu WZ et. al., *Inhibition of Type II Collagen-Induced Arthritis In Rats By Triptolide*, INT J IMMUNOPHARMACOL Aug;20(8):389-400 (1998); Ren L. et. al., *The Effects of Tripterygium Wilfordii Extract on Adjuvant Arthritis in Rats*, FUKUOKA-IGAKU-ZASSHI Jan; 86(1): 6-11 (1995); Gu WZ et. al., *Inhibition of Type II Collagen Induced Arthritis In Mice By An Immunosuppressive Extract of Tripterygium Wilfordii Hook F.*, J-RHEUMATOL May; 19(5): 682-8 (1992);
- 7/ See e.g., Tao XL et. al., *A Prospective, Controlled, Double-blind, Cross-over Study of Tripterygium Wilfordii Hook F in Treatment of Rheumatoid Arthritis*, MED-J-ENGL May; 102(5): 327-32 (1989); Zeng X et. al., *The Effects Of A Single Active Ingredient (T4) Of Tripterygium Wilfordii Hook On The Production Of Tumor Necrosis Factor By The Peripheral Blood Mononuclear Cells And Synovium Cells Of Rheumatoid Arthritis Patients*, CHUNG KUO I HSUEH KO HSUEH YUAN HSUEH PAO Apr;18(2):138-42 (1996); Li RL et. al., *Clinical and experimental study on sustained release tablet of Tripterygium wilfordii in treating rheumatoid arthritis*, CHUNG KUO CHUNG HSI I CHIEH HO TSA CHIH Jan;16(1):10-3 (1996); QP et. al., *Effects of Tripchlorolide (T4) of Tripterygium Wilfordii Hook on the Production of Prostaglandin E2 by Synovial Cells of Rheumatoid Arthritis*, YAO-HSUEH-HSUEH-PAO 29(10): 790-2 (1994); Ye WH, *Mechanism of Treating Rheumatoid Arthritis With Polyglycosides of Tripterygium Wilfordii Hook (T II). III. Study on Inhibitory Effect of T II on In Vitro Ig Secreted by Peripheral Blood Mononuclear Cells From Normal Controls and RA Patients*, CHUNG-KUO-I-HSUEH-KO-HSUEH-YUAN-HSUEH-PAO Jun; 12(3): 217-22 (1990); Tao XL, *Mechanism of Treating Rheumatoid Arthritis With Tripterygium Wilfordii Hook. II. Effect on PGE2 Secretion*, CHUNG-KUO-I-HSUEH-KO-HSUEH-YUAN-HSUEH-PAO Feb; 11(1): 36-40 (1989).

The undersigned certifies that the information presented and contained in this notification is complete and accurate, and that China Shanxi ZhengZhong Group Co., Ltd. has substantiation that each structure/function statement is truthful and not misleading.

Sincerely,

 9.9.9.10.
Yueming Shi
President, China Shanxi ZhengZhong Group Co., Ltd.

Attachments

PHARMACOPOEIA OF THE PEOPLE'S REPUBLIC OF CHINA

(English Edition 1997)

Volume I

Compiled by The Pharmacopoeia Commission of PRC

**CHEMICAL INDUSTRY PRESS
BEIJING, CHINA**

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PHARMACOPOEIA OF THE PEOPLE'S REPUBLIC OF CHINA

(English Edition 1997)

Volume I

This Pharmacopoeia is the English version edited from Pharmacopoeia of the People's Republic of China 1995 edition. The Chinese edition is approved by the Ministry of Public Health of the People's Republic of China to be effective from April 1, 1996, in accordance with the official document WYF (95) 77.

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Contents

Membership of the 6th Pharmacopoeia Commission of the Ministry of Public Health, the People's Republic of China	IV
Editorial Board of Pharmacopoeia of the People's Republic of China. Volume I , English Edition (1997)	VI
Preface	VII
History of the Pharmacopoeia of the People's Republic of China	IX
Additions	X V
Omissions	X VI
General Notices	X VII
Monographs	
Part I Chinese Materia Medica, Oil, Fats, etc.	1
Part II Traditional Chinese Patent Medicines and Simple Preparations	235
Appendices	A-1
Index	I-1

der reflux for 15 minutes. Allow to cool, transfer to a separator. Separate the chloroform layer and shake with 10 ml of sodium hydroxide TS, allow to stand; a red colour is produced in aqueous layer. If a brown colour is produced, add 1~2 drops of hydrogen peroxide TS to the separated aqueous layer and heat for 4 minutes in a water bath, a red colour is produced.

(2) Macerate 1 g of the powder with 10 ml of methanol for 1 hour, filter, evaporate the filtrate to dryness, dissolve the residue with 10 ml of water, add 1 ml of hydrochloric acid, heat on a water bath for 30 minutes, cool immediately, extracted with two quantities, each of 20 ml, of ether, combined the test solution, evaporate to dryness, dissolve the residue with 1 ml of chloroform as the test solution. Dissolve emodin and chrysophanol CRS with ethanol to produce a solution containing each of 1 mg per ml as the references solution. Carry out the method for thin layer chromatography (Appendix VI B), using silica gel H containing sodium carboxymethylcellulose as the coating substance and petroleum ether (30~60°C)-ethyl formate-formic acid (15:5:1) as the mobile phase. After developing and removal of the plate, dry it in air, examine under ultra-violet light (365 nm). The orange fluorescent spots in the chromatogram obtained with the test solution correspond in position and colour to the spots in the chromatogram obtained with the reference solution. The spots turn to red on exposure to ammonia vapour.

Processing *Semen Cassiae* Eliminate foreign matter, wash clean and dry. Break into pieces before use.

Semen Cassiae (stir-fried) Stir-fry the clean *Semen Cassiae* as described under the method for simple stir-frying (Appendix II D) until slightly scented. Break into pieces before use.

Action To remove heat from the liver, to improve eyesight, and to relax bowels.

Indications Inflammation of the eye with pain, photophobia and lacrimation; headache, dizziness, blurred vision and constipation.

Usage and dosage 9~15 g.

Storage Preserve in a dry place.

Semen Celosiae

(青箱子, Qingxiangzi)

Feather Cockscomb Seed

Feather Cockscomb Seed is the dried ripe seed of *Celosia argentea* L. (Fam. Amaranthaceae). The plant is cut up or the infructescence is picked up in autumn when the fruit is ripe, dried in the sun, and the seed is gathered and removed from foreign matter.

Description Oblate, a few rounded-reniform, 1~1.5 mm in diameter. Externally black or reddish-black, lustrous, somewhat raised at middle, with a hilum on the slightly dented lateral side. Testa thin and brittle. Odourless; tasteless.

Foreign matter Not more than 2% (Appendix IX A).

Action To remove heat from the liver, and to clear the eye of corneal opacity.

Indications Redness of the eye and dizziness due to excessive heat or fire in the liver; nebula with blurred vision.

Usage and dosage 9~15 g.

Storage Preserve in a dry place.

Semen Citri Reticulatae

(桔核, Juhe)

Tangerine Seed

Tangerine Seed is the dried ripe seed of *Citrus reticulata* Blanco and its other cultivars (Fam. Rutaceae). The drug is collected after the fruit ripened, washed clean, and dried in the sun.

Description Slightly ovoid, 8~12 mm long, 4~6 mm in diameter. Externally pale yellowish-white or pale greyish-white, smooth, with raphe line on one side, one end obtuse-rounded and the other end acuminate and small stalk-shaped. Testa thin, tenacious; endotesta thin, pale brown, cotyledons 2, yellowish-green, oily. Odour, slight; taste, bitter.

Identification Transverse section: Epidermal cells of testa consisting of rows of mucilage cells, with 1 row of palisade-arranged sclerenchymatous cells underneath, outer walls even or with a tail-like convex at the upper end, cell walls lignified, pitted and uneven in thickness; cells of pigment layer containing orange-yellow or yellowish-brown contents and prisms of calcium oxalate, 7~16 μ m in diameter. Endosperm cells 3~4 rows, some cell walls beaded, containing oil droplets. Cotyledon cells containing fine clusters or prisms of calcium oxalate, oil droplets and rosette crystals of hesperidin.

Processing *Semen Citri Reticulatae* Eliminate foreign matter, wash clean and dry. Break into pieces before use.

Semen Citri Reticulatae (processed with salt) Stir-fry the clean *Semen Citri Reticulatae* as described under the method for stir-frying with salt (Appendix II D) to dryness and break into pieces before use.

Action To regulate the flow of qi, cause subsidence of nodulation, and relieve pain.

Indications Hernia; painful swelling of the testis; mastitis with formation of painful nodules.

Usage and dosage 3~9 g.

Storage Preserve in a dry place, protected from mould and moth.

Semen Coicis

(薏苡仁, Yiyiren)

Coix Seed

Coix Seed is the dried ripe kernel of *Coix lacrymajobi* L. var. *ma-yuen* (Roman.) Stapf (Fam. Gramineae). The plant is collected in autumn when the fruit is ripe and dried in the sun. The fruit is picked up, dried in the sun, and the kernel is separated from the shell, yellowish-brown coat, and foreign matter.

Description Broad ovoid or elongated-elliptical, 4~8 mm long, 3~6 mm wide. Externally milky white, smooth, occasionally with yellowish-brown testa. One end obtusely

rounded, the other end relatively broad and slightly dented with 1 pale brown dotted hilum. Dorsal surface rounded and protruding; ventral surface having 1 relatively broad and deep longitudinal furrow. Texture hard, fracture white and starchy. Odour, slight; taste, slightly sweet.

Identification Powder: Whitish. Starch granules numerous, simple granule subrounded or polyhedral, 2~20 μ m in diameter, hilum stellate; compound granules seldom visible, usually consisting of 2~3 components. On adding iodine TS, the starch showing a brownish-red colour.

Processing *Semen Coicis* Eliminate foreign matter.

Semen Coicis (stir-fried) Stir-fry the clean *Semen Coicis* as described under the method for stir-frying with bran (Appendix II D) until a pale yellow colour is produced.

Action To invigorate the spleen function and promote diuresis, to alleviate arthritis, to arrest diarrhea, to remove heat and facilitate the drainage of pus.

Indications Edema, oliguria; arthritis with contracture of joints; diarrhea due to diminished function of the spleen; lung abscess, appendicitis; verruca plana.

Usage and dosage 9~30 g.

Storage Preserve in a ventilated and dry place, protected from moth.

Semen Crotonis Pulveratum

(巴豆霜, Badoushuang)

Defatted Croton Seed Powder

Defatted Croton Seed Powder is a processed product of Croton Seed.

Processing Treat the clean Croton Seed as described under the method for frost-like powder (Appendix II D), or pulverize the seed and determine its content of fatty oil, add sufficient starch to make the fatty oil content in compliance with the requirement and mix well.

Description A pale yellow, lax powder, homogeneous in size, oily in appearance.

Identification Complies with the tests for Identification described under Fructus Crotonis.

Assay Heat under reflux about 5 g of the powder, accurately weighed, in a Soxhlet's extractor with 100 ml of ether for 6~8 hours to exhaust fatty oil. Transfer the extract to the evaporating dish dried to constant weight, remove the ether at a low temperature on a water bath. Dry the residue at 100°C for 1 hour, cool, and weigh accurately.

It contains 18%~20% of fatty oil.

Action To cause drastic purgation, to relieve edema, and to soothe the throat.

Indications Constipation and indigestion due to accumulation of cold; ascites and edema with oliguria and constipation; inflammation of the throat.

Usage and dosage 0.1~0.3 g; mostly used for making pills or powder.

Precaution Contraindicated in pregnancy. Incompatible with *Semen Pharbitidis*.

Storage Preserve in a cool and dry place.

Semen Cuscutae

(菟丝子, Tusizi)

Dodder Seed

Dodder Seed is the dried ripe seed of *Cuscuta chinensis* Lam. (Fam. Convolvulaceae). The plant is collected in autumn when the fruit is ripe, dried in the sun, the seed is collected and removed from foreign matter.

Description Subspherical, 1~1.5 mm in diameter. Externally greyish-brown or yellowish-brown, with numerous fine projecting dots, a slightly sunken linear raphe at one end. Texture hard, difficult to break with finger. Odour, slight; taste, weak.

Identification Macerate a small quantity in boiling water, a mucilage is produced on the surface; boil until the testa is broken, yellowish white silky rotary embryo is revealed.

Total ash Not more than 10.0% (Appendix IX K).

Processing *Semen Cuscutae* Eliminate foreign matter, wash clean, dry in the sun.

Semen Cuscutae (stir-fried with salt-water) Stir-fry the clean *Semen Cuscutae* as described under the method for stir-frying with salt-water (Appendix II D) until the seeds become slightly convex.

Externally brownish-yellow, broken and slightly aromatic. A mucilage is produced on the surface after macerating the processed *Semen Cuscutae* in an appropriate quantity of boiling water. A yellow to dark brown curved and rotary embryo is revealed after boiling.

Action To arrest seminal discharge and abnormal urination, prevent abortion, improve eyesight and relieve diarrhea by replenishing and tonifying the liver and the kidney.

Indications Impotence, seminal emission, dripping of urine after urination, enuresis, frequent urination, aching and weakness of the loins and knees, blurred vision and tinnitus; threatened abortion due to hypofunction of the kidney; diarrhea due to hypofunction of the spleen and the kidney; external use for vitiligo.

Usage and dosage 6~12 g, appropriate quantity for external use.

Storage Preserve in a ventilated and dry place.

Semen Euphorbiae

(千金子, Qianjinzi)

Caper Euphorbia Seed

Caper Euphorbia Seed is the dried ripe seed of *Euphorbia lathyris* L. (Fam. Euphorbiaceae). The drug is collected in summer and autumn when the fruit is ripe, removed from foreign matter, and dried.

Description Ellipsoidal or ovoid, about 5 mm long, 4 mm in diameter. Externally greyish-brown, with irregular reticulated wrinkles, greyish-black in the dents of reticulated pits, forming fine spots. A longitudinally furrowed

several to more than 10 layers of cells. Cortex narrow. Sieve tube groups of phloem distinct. Cambium in a ring. Xylem well developed, medullar rays broad, more than 10 cells wide. Parenchymatous cells containing sand crystals of calcium oxalate, mainly in ray cells.

(2) Macerate 1 g of the powder in 10 ml of dehydrated ethanol for 15 minutes and filter. Examine 2 ml of the filtrate under an ultra-violet light (365 nm); a brilliant blue and slight purple fluorescence is shown.

Acid-insoluble ash Not more than 5.0% (Appendix IX K).

Processing Eliminate foreign matter, wash clean, soften thoroughly, cut into thick pieces, and dry.

Action To relieve fever in deficiency conditions.

Indications Fever due to deficiency of yin, consumptive fever, fever in infantile malnutrition.

Usage and dosage 3~9 g.

Storage Preserve in a ventilated dry place, protected from moth.

Radix Stemonae

(百部, Baibu)

Stemona Root

Stemona Root is the dried root tuber of *Stemona sessilifolia* (Miq.) Miq., *Stemona japonica* (Bl.) Miq. or *Stemona tuberosa* Lour. (Fam. Stemonaceae). The drug is collected in summer and autumn, removed from rootlet, washed clean, treated with boiling water for a moment or steamed until the centre of the cut surface is devoid of a white core, and dried in the sun.

Description Root of *Stemona sessilifolia* Fusiform, the upper end relatively slender, shrunken and curved, 5~12 cm long, 0.5~1 cm in diameter. Externally yellowish-white or pale brownish-yellow, with irregular longitudinal deep furrows, and occasionally transverse wrinkles. Texture fragile, easily broken, fracture even, horny, pale yellowish-brown or yellowish-white, bark broad, stele compressed. Odour, slight; taste, sweet and bitter.

Root of *Stemona japonica* Two ends slightly thinned, externally mostly with irregular longitudinal folds and transverse wrinkles.

Root of *Stemona tuberosa* Long fusiform or long spat-shaped, 8~24 cm long, 0.8~2 cm in diameter. Externally yellowish-brown to greyish-brown, with shallow longitudinal wrinkles or irregular longitudinal furrows. Texture compact, fracture yellowish-white or dark brown, stele large, pith whitish.

Identification (1) Transverse section:

Root of *Stemona sessilifolia* Velamen of 3~4 layers of cells, walls suberized and lignified with dense and fine striations. Cortex relatively broad. In stele phloem bundles and xylem bundles 19~27, respectively, arranged alternately, with a few non-lignified fibres in the inner side of phloem bundles; xylem bundles with 2~5 vessels, xylem fibres and tracheids, vessels subpolygonal, 48 μ m in diameter, radially, occasionally penetrating into the pith. A few small fibres scattered in pith.

Root of *Stemona japonica* Velamen of 3~6 layers of

cells. Phloem fibres lignified. Vessels up to 184 μ m in diameter, radially, usually penetrating into pith, arranged in 2~3 whorls.

Root of *Stemona tuberosa* Velamen of 3 layers of cells, walls without fine striations, the inner walls of the inner layers heavily thickened. Fibres scattered in the outer part of cortex, subsquare, with slightly lignified walls. In stele, phloem bundles 36~40. Vessels in xylem bundles rounded-polygonal, up to 107 μ m in diameter. The inner sides of xylem bundles linked up with xylem fibres and slightly lignified parenchymatous cells into a ring.

(2) Heat under reflux 5 g of the powder with 50 ml of 70% ethanol for 1 hour, filter, evaporate the filtrate to remove ethanol. To the residue add concentrated ammonia TS, adjust to pH 10~11, extract with 5 ml of chloroform. Evaporate the chloroform solution to dryness, dissolve the residue in 5 ml of 1% hydrochloric acid solution and filter. Separate the filtrate into two portions. To one portion add 1 drop of potassium iodobismuthate TS, an orange-red precipitate is produced; to another portion add 1 drop of silicotungstic acid TS, a milky-white precipitate is produced.

Extractives Carry out the hot extraction method described under the determination of water-soluble extractives (Appendix V A), not less than 50.0%.

Processing *Radix Stemonae* Eliminate foreign matter, wash clean, soften thoroughly, cut into thick slices, and dry.

Occurring in irregular thick slices or irregular spat-shaped oblique slices; externally greyish-white or brownish-yellow, deep wrinkled longitudinally; cut surface greyish-white, pale yellowish-brown or yellowish-white, horny; bark relatively thick, stele compressed. Texture flexible and soft. Odour slight; taste sweet and bitter.

Radix Stemonae (Stir-fried with honey) Stir-fry the slices of *Radix Stemonae* as described under the method for stir-frying with honey (Appendix II D) until it is not sticky to fingers, using 12.5 kg of refined honey for 100 kg of *Radix Stemonae*.

The form similar to the slice of *Radix Stemonae*, but externally brownish-yellow or brown, with less burnt specks, slightly sticky. Taste sweet.

Action To moisten the lung and relieve cough, and to kill insects and worms.

Radix Stemonae (Stir-fried with honey) To moisten the lung and relieve cough.

Indications Acute and chronic cough, cough in phthisis, whooping cough; external use: for pediculosis capitis, pediculosis corporis, oxyuriasis, pudendal itching.

Radix Stemonae (Stir-fried with honey) cough in phthisis

Usage and dosage 3~9 g; for external use, appropriate quantity to be decocted with water or infused in wine.

Storage Preserve in a ventilated dry place, protected from moisture.

Radix Stephaniae Tetrandrae

(防己, Fangji)

Fourstamen Stephania Root

Fourstamen Stephania Root is the dried root of *Stephania tetrandria* S. Moore (Fam. Menispermaceae).

maceae). The drug is collected in autumn, washed clean, removed from the outer coarse bark, half-dried in the sun, cut into section; the large one is cut longitudinally; and dried.

Description Irregularly cylindrical, semi-cylindrical or lump-shaped, mostly tortuous, 5~10 cm long, 1~5 cm in diameter. Externally greyish-yellow, usually exhibiting deeply depressed transverse grooves and appearing as knotty-knobby at the curved part. Texture heavy and compact, fracture even, greyish-white, starchy, sparsely. Odour, slight; taste, bitter.

Identification (1) Transverse section: Remaining cork sometimes visible. Cortex scattered with stone cells groups, usually arranged tangentially. Phloem relatively broad. Cambium in a ring. The greater part occupied by xylem, rays wide; vessels rare, radially arranged, accompanied by wood fibres. Parenchymatous cells filled with starch granules and a few minute rod-shaped crystals of calcium oxalate.

(2) Heat about 2 g of the powder with 20 ml of sulfuric acid solution (0.5 mol/L) for 10 minutes and filter, adjust the filtrate to pH 9 by adding ammonia TS, transfer to a separator and extract with 25 ml of benzene. Evaporate 5 ml of benzene extract to dryness and add several drops of molybdo-sulfuric acid TS to the residue, a violet colour is produced which gradually becomes a green to dirty green colour and deepens on standing.

(3) Heat under reflux 1 g of the powder with 15 ml of ethanol for 1 hour, cool, filter and evaporate the filtrate to dryness. Dissolve the residue in 5 ml of ethanol as the test solution. Dissolve tetrandrine CRS and fangchinoline CRS in chloroform to produce a mixture containing 1 mg of each per ml as the reference solution. Carry out the method for thin layer chromatography (Appendix VI B), using silica gel G as the coating substance and chloroform-acetone-methanol (6:1:1) as the mobile phase. Apply separately to the plate 5 μ l of each of the two solutions. After developing and removal of the plate, dry it in air, and spray with dilute potassium iodobismuthate TS. The spots due to tetrandrine and fangchinoline in the chromatogram obtained with the test solution correspond in position and colour with the spots in the chromatogram obtained with the reference solution.

Assay Weigh accurately about 1 g of the powder (through No. 3 sieve), previously dried at 80°C for 4 hours, to a Soxhlet's extractor, add 6 drops of concentrated ammonia solution, stand for 1 hour, then add a quantity of chloroform and heat under reflux on a water bath for about 6 hours. After recovering of chloroform on a water bath, cool and dissolve the residue in absolute ethanol, transfer to a 2 ml volumetric flask, add absolute ethanol to volume, mix well as the test solution. Dissolve tetrandrine CRS in chloroform to produce a solution containing 2 mg of per ml as the reference solution. Carry out the method for thin layer chromatogram (Appendix VI B), using silica gel G as the coating substance and chloroform-acetone-methanol-concentrated ammonia (20:3:2:0.1) as the mobile phase. Apply accurately in strip to the plate 100 μ l of the test solution and 10 μ l of the reference solution beside. After developing and removal of the plate, exposure immediately under ultra-violet light (365 nm) for about 10 minutes. Scarpe off the strip of the test preparation corresponding in position with the reference spot, and scarpe off equal area of silica gel G on the same plate as a blank. Packed to two column (0.7 cm \times 10 cm). Carry out the method for column chromatography (Appendix VI C), elute with 30 ml of methanol, collect the eluate in an evaporating dish and evaporate to dryness on a water bath. Allow to cool, add accurately 10 ml of hy-

drochloric acid solution (0.1 mol/L) and dissolve the residue completely. Carry out the method for spectrophotometry (Appendix V A), measure the absorbance of the resulting solution at 280 nm. Calculate the content of $C_{38}H_{42}N_2O_6$, taking 113 as the value of A (1%, 1 cm).

It contains not less than 0.7% of tetrandrine ($C_{38}H_{42}N_2O_6$), calculated on the dried drug at 80°C for 4 hours.

Processing Eliminate foreign matter, soak briefly, wash clean, soften thoroughly, cut into thick slices, and dry. Occurring in subrounded or broken thick slices, edges rather dark in colour, cut surface greyish-white, starchy, with sparse radial striations. Odour slight; taste bitter.

Action To cause diuresis and to relieve rheumatic conditions.

Indications Edema with oliguria; eczema; rheumatic arthritis; hypertension.

Usage and dosage 4.5~9 g.

Storage Preserve in a dry place, protected from mould and moth.

Radix Tinosporae

(金果榄, Jinguolan)

Tinospora Root

Tinospora Root is the dried root tuber of *Tinospora sagittata* (Oliv.) Gagnep. or *Tinospora capillipes* Gagnep. (Fam. Menispermaceae). The drug is collected in autumn and winter, removed from rootlet, washed clean, and dried in the sun.

Description In irregular masses, 5~10 cm long, 3~6 cm in diameter. Externally brownish-yellow or brownish, rugged, deeply wrinkled. Texture hard, uneasily broken, transversely cut surface yellowish-white when dissected, showing vessels in groups, arranged somewhat radially. Odourless; taste bitter.

Processing Eliminate foreign matter, soak, soften thoroughly, cut into thick slices, and dry.

Action To remove toxic heat, to cure sore throat and to relieve pain.

Indications Swelling and pain of the throat, carbuncles and boils; diarrhea, dysentery; epigastric pain of heat type.

Usage and dosage 3~9 g; for external use, appropriate quantity to be ground into powder and insufflated into the throat, or to be ground together with vinegar and applied topically.

Storage Preserve in a dry place, protected from moth.

Radix Trichosanthis

(天花粉, Tianhuafen)

Snakegourd Root

Snakegourd Root is the dried root of *Trichosanthes kirilowii* Maxim. or *Trichosanthes rosthornii* Herms (Fam. Cucurbitaceae). The drug is col-

Herba Selaginellae**(卷柏, Juanbai)**

Spikemoss

Spikemoss is the dried herb of *Selaginella tamariscina* (Beauv.) Spring or *Selaginella puluinata* (Hook. et Grev.) Maxim. (Fam. Selaginellaceae). The drug is collected all the year round, removed from fibrous root and soil, and dried in the sun.

Description Herb of *Selaginella tamariscina* Crumpled into fistled masses, 3–10 cm long. Branches fascicled, flat and branched, green or brownish-yellow, curved inward, densely growing scaly leaflets, long-aristate at the apex, central leaves (ventral leaves) 2 lines, ovate-oblong, arranged obliquely upward, margin membranous, irregularly serrulate. Dorsal leaves (lateral leaves), membranous margin of dorsal surface frequently brownish-black. Fibrous roots remained at the base brown, scattered or clustered in short rods. Texture fragile, easily broken. Odourless; taste, weak.

Herb of *Selaginella puluinata* Basically similar to *Selaginella tamariscina*, but most of fibrous roots scattered. Central leaves (ventral leaves) 2 lines, ovate-lanceolate, arranged straightly upward. Leaves unsymmetrical, the inner side relatively straight, the outer side frequently thickened by folding inward, entire.

Processing *Herba Selaginellae* Eliminate remained fibrous roots and foreign matter, wash clean, cut into sections, and dry in the sun.

***Herba Selaginellae* (carbonized)** Stir-fry the clean *Herba Selaginellae* as described under the method for carbonizing by stir-frying (Appendix II D) until a charred black colour is produced externally.

Action To promote blood circulation and to stimulate menstrual discharge.

Herba Selaginellae (carbonized): To remove blood stasis and to arrest bleeding.

Indications Amenorrhea, dysmenorrhea, mass formation in the abdomen.

Herba Selaginellae (carbonized): Spitting of blood, abnormal uterine bleeding, hematochezia, prolapse of rectum.

Usage and dosage 4.5–9 g.

Precaution Used with caution in pregnancy.

Storage Preserve in a dry place.

Herba Siegesbeckiae**(豨薟草, Xixiancao)**

Siegesbeckia Herb

Siegesbeckia Herb is the dried aerial part of *Siegesbeckia orientalis* L., *Siegesbeckia pubescens* Makino or *Siegesbeckia glabrescens* Makino. (Fam. Compositae). The drug is collected in summer and autumn before or at flowering stage, removed from foreign matter, and dried in the

sun.

Description Stems subsquare, frequently branched, 30–110 cm long, 0.3–1 cm in diameter; externally greyish-green, yellowish-brown or purplish-brown, with longitudinal furrows and fine longitudinal striations, covered with grey pubescences; nodes distinct, slightly swollen; texture fragile, easily broken, fracture yellowish-white or green; pith broad, whitish, hollowed. Leaves opposite, lamina frequently crumpled and rolled, when whole, ovate, greyish-green, margin obtusely serrate; both surfaces with white pubescences, trinervious. Some showing yellow capitulum; involucre spatulate. Odour, slight; taste, slightly bitter.

Processing *Herba Siegesbeckiae* Eliminate foreign matter, wash, soften slightly, cut into sections, and dry.

***Herba Siegesbeckiae* (processed with wine)** Steam the sections of *Herba Siegesbeckiae* thoroughly as described under the method for steaming with wine (Appendix II D), using 20 kg of yellow rice wine per 100 kg of *Herba Siegesbeckiae*.

Action To relieve rheumatic conditions, to improve the motility of joints, and to counteract toxicity.

Indications Rheumatic arthralgia with aching and weakness of the loins and knees, and numbness of the limbs; hemiplegia; rubella, sores with exudation.

Usage and dosage 9–12 g.

Storage Preserve in a ventilated dry place.

Preparation Siegesbeckia Pills.

Herba Spirodelae**(浮萍, Fuping)**

Common Ducksmeat Herb

Common Ducksmeat Herb is the dried whole plant of *Spirodela polyrrhiza* (L.) Scheid. (Fam. Lemnaceae). The drug is collected from June to September, washed clean, removed from foreign matter, and dried in the sun.

Description Flat thallophyte, ovoid or ovate, 2–5 mm in diameter on the long side. The upper surface pale green to greyish-green, with a small pit on the side, margin entire or slightly curved. The lower surface purple to purplish-brown, with several fibrous roots. Texture light, easily broken when twisted. Odour, slight; taste, weak.

Action To dispel wind-heat, to promote eruption, and to cause diuresis.

Indications Measles without adequate eruption, urticaria with itching; edema with oliguria.

Usage and dosage 3–9 g; for external use, appropriate quantity to be decocted for washing or immersion.

Storage Preserve in a ventilated dry place, protected from moisture.

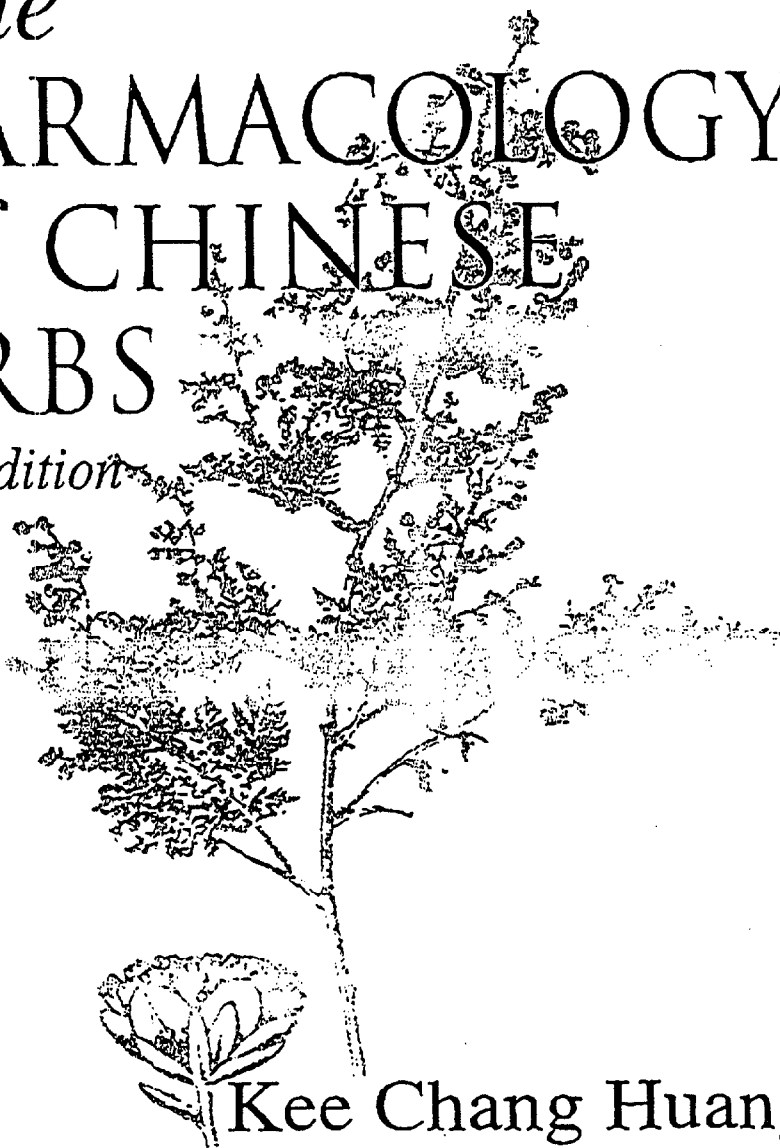
Herba Swertiae Mileensis**(青叶胆, Qingyedan)**

Mile Swertia Herb

Mile Swertia Herb is the dried whole plant of

The
PHARMACOLOGY
of CHINESE
HERBS

Second Edition



Kee Chang Huang



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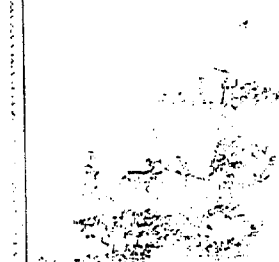
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The Pharmacology of Chinese Herbs, Second Edition presents the chemical composition, pharmacological action, toxicity, and therapeutic value of 473 herbs—providing a singular correlation between Western pharmacology and the teachings of traditional Chinese medicine. This second edition includes new discussions on immune activity and autoimmune diseases and the effect of herbs on fertility/infertility. Information is also provided about herbs of current interest such as anti-cancer, anti-HIV, anti-Alzheimer's, and anti-malarial herbs. This edition serves as an exceptional resource for pharmacologists, physicians interested in herbal medicine, and toxicologists.

Features

- Describes the pharmacological actions of 473 herbs based on the most recent scientific data
- Contains short discussions on the general principles of each herb as well as the criteria used by the Chinese to judge the effectiveness of the herb
- Lists the chemical component and structure of each herb
- Provides the Chinese symbols for Chinese terms

1665

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James A. Duke, co-author of *Medicinal Plants of China*, is a renowned ethnobotanist, who has travelled widely in that country.

Born in Birmingham, Alabama, in 1929, he graduated from the University of North Carolina, and undertook post-doctoral work at Washington University, and the Missouri Botanical Garden. From 1963-65, he was with the U.S. Department of Agriculture. From 1965-71, he was with Batelle Columbus Laboratories, for whom he undertook ecological and ethnological studies in Panama and Colombia. In 1971 he returned to the Department of Agriculture to undertake crop diversification and medicinal plant studies in developing countries. A key figure in the "Herbal Renaissance," he received the Cutty Sark Award in 1981. He is currently Chief, Germplasm Resources, at the Department of Agriculture in Beltsville, Maryland.

The author of more than 100 scientific publications, his other books include *A Handbook of Legumes of World Economic Importance*, *Medicinal Plants of the Bible*, and *A Culinary Herbal*.

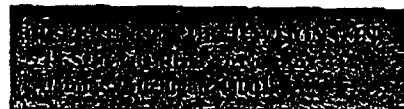
Cover photo by Edward S. Ayensu
The Sacred Lotus
Pinyin name: lián zǐ
Nelumbic nucifera
(See page 458)



Edward S. Ayensu, co-author of *Medicinal Plants of China*, is also editor of the series "Medicinal Plants of the World," to which it belongs. He has travelled to China several times, visiting different regions of the country.

One of the world's eminent botanists and tropical biologists, who obtained his doctorate degree from the University of London, Professor Ayensu, a Ghanaian, is Director of the Smithsonian's Office of Biological Conservation, and was formerly Chairman of the Institution's Botany Department. He is a Fellow of the Ghana Academy of Arts and Sciences, and a Foreign Fellow of the Indian National Science Academy. He belongs to many professional organizations, including the Linnean Society of London. He serves as Secretary General of the International Union of Biological Sciences, and is also a member of the W.H.O Panel on Traditional Medicine.

Among his research interests are tropical biology and ecology, and science and technology, especially in developing countries. He has authored *Medicinal Plants of West Africa*, *Medicinal Plants of the West Indies*, and other works.



**MEDICINAL PLANTS
of
CHINA**

Vol. 1

**James A. Duke
Edward S. Ayensu**

REFERENCE PUBLICATIONS, INC.

FANG JI (防己) OR HAN FANG JI (漢防己)

The dried tuberous root of *Stephania tetrandra* S. Moore
(Menispermaceae)



Figure 8.1 (A) Fan Ji; (B) Mu Fang Ji.

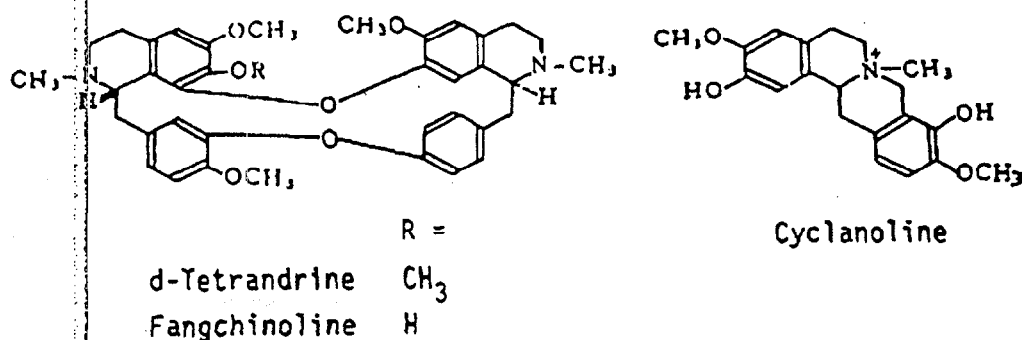
Chemistry: The total alkaloid content of this herb is between 1.5 to 2.3%. The primary alkaloids found are *d*-tetrandrine (漢防己素, approximately 1%), fangchinoline (0.5%), and cyclanoline (0.1%).

Table 8.1 Known Components Isolated from Different *Fang Ji*

Name of <i>Fang Ji</i>	Major components	Chemical formula	Melting point (°C)
Han <i>Fang Ji</i>	Tetrandrine	$C_{38}H_{42}O_6N_2$	217
<i>Stephania tetrandra</i>	Demethyltetrandrine	$C_{37}H_{40}O_6N_2$	241–242
Mu <i>Fang Ji</i> (Kong <i>Fang Ji</i>)	Mufangchine A	$C_{32}H_{24}O_{13}N_2$	278–280
Ji, Ting; <i>Fang Ji</i>)	Mufangchine B	$C_{14}H_{23}O_{11}N$	232–233
<i>Cocculus thunbergii</i>	(Mufangchine)		
Japanese Han <i>Fang Ji</i>	Sinomenine	$C_{19}H_{23}O_4N$	162, 182
<i>Sinomenium acutum</i>	Disinomenine	$(C_{19}H_{22}O_4N)_2 \cdot 2CH_3OH$	222
	Sinactine	$C_{20}H_{21}O_4N$	174
	Acutumine	$C_{20(21)}H_{27}O_8N$	240
	Diversine	$C_{20}H_{27}O_5N$	80–93
	Tuduranine	$C_{18}H_{29}O_3N$	125
Japanese Mu <i>Fang Ji</i>	Trilobine	$C_{36}H_{36}O_3N_2$	235
<i>Cocculus trilobus</i>	Isotrilobine	$C_{36}H_{36}O_3N_2$	215

It should be pointed out once again that Chinese herbal terminology is very confusing. Chinese *Fang Ji*, as described here, is generally called *Han Fang Ji* (汉防己) and differs considerably from Japanese *Fang Ji* (日本防己), which is derived from the root of *Sinomenium acutum* Rehder et Wilson. The latter contains the alkaloids sinomenine and disinomenine, which are phenanthrene derivatives similar to morphine.

Japanese *Mu Fang Ji* (日本木防己) is the root of *Cocculus trilobus*, which contains the alkaloids trilobine and isotrilobine. Both have structures very similar to tetrandrine, a *d*-tubocurarine-like substance (see Table 8.1).



Actions: The herb has a curare-like action. Methylated tetrandrine and metetrandrine iodine were found to be 4 times more potent than *d*-tubocurarine in their ability to block the depolarizing action of acetylcholine on the NMJ.

Fang Ji has anti-inflammatory and antihypersensitivity actions. The herb has a direct stimulatory effect on adrenal corticosterone secretion. Feng et al.⁸ reported that sinomenine exerts a marked immunosuppressive effect and significantly decreases the ratio of cGMP/cAMP of plasma in mice.

The herb has analgesic properties. Japanese *Fang Ji* and sinomenine are as effective as morphine in relieving pain.

Fang Ji, especially *d*-tetrandrine, displays antiarrhythmic effects; its action is similar to quinidine (see Chapter 3).

Toxicity: Overdose may cause respiratory paralysis. Therapeutic doses, however, have little effect on the heart or respiration. Occasionally, patients may develop cyanosis and excess sweating.

The LD_{50} of metetrandrine in mice is 1.3 mg/kg (i.v.), ten times greater than that of *d*-tubocurarine.

Therapeutic Uses: Popular prescriptions of *Fang Ji* include use as a diuretic, antiphlogistic, and antirheumatic.

As an adjuvant in anesthesia for abdominal operations, metetrandrine has been used in combination with acupuncture to obtain a good anesthetic effect. The dose used is 0.8 mg/kg administered intramuscularly, or diluted to 5 to 10 ml with isotonic glucose solution for intravenous injection. It usually takes 2 to 5 min to produce complete muscle relaxation, which will last for 40 min. In some cases, a drop in blood pressure has been observed.

In the treatment of arthritis and neuralgia, the standard dose is 6 to 12 g daily; if *d*-tetrandrine tablets (0.02 g) are used, the dose is 1 to 2 tablets t.i.d. Tetrandrine is also used as an antiarrhythmic agent to replace quinidine.

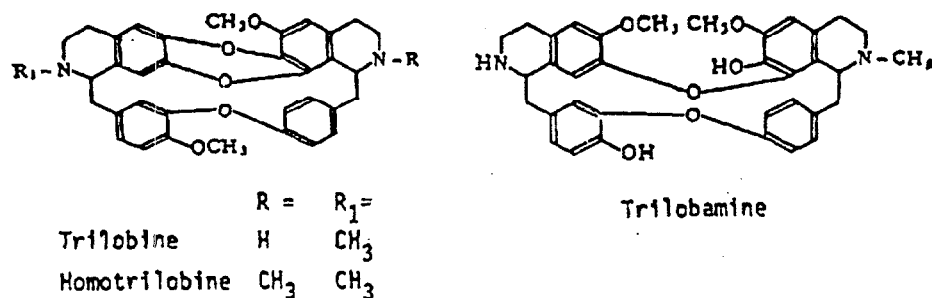
MU FANG JI (木防已)

The dried root of *Cocculus thunbergii*;

JAPANESE MU FANG JI (日本木防已)

The dried root of *Cocculus trilobus* (Thunb.)

Chemistry: The root or rhizome contains several alkaloids. The major ones are magnoflorine ($C_{20}H_{24}O_4N$, approximately 0.41%), trilobine, homotrilobine, etc. Their structures are shown as follows:



GAN CAO (甘草), OR LICORICE ROOT

The dried root and rhizome of *Glycyrrhiza uralensis*, *G. inflata*, or *G. glabra*

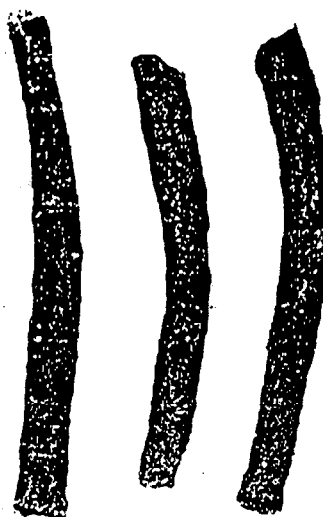
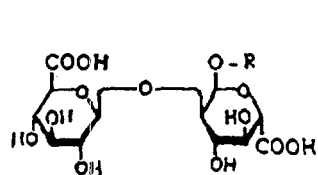


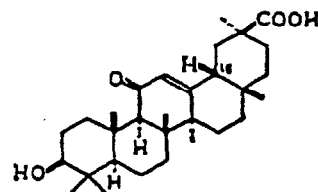
Figure 34.1 Gan Cao, the licorice root.

Chemistry: Between 6 and 14% of the herb by weight consists of glycyrrhizin, which is the Ca^{2+} or K^+ salt of glycyrrhinic acid. Glycyrrhizin is about 170% sweeter than cane sugar. After water hydrolysis, it gives one molecule of glycyrrhetic acid and two molecules of glucuronic acid.

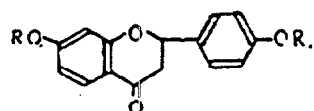
The plant also contains small amounts of glycosides called liquiritin, isoliquiritin, and neoliquiritin. Recently, an antiulcerative FM 100 fraction, or licorione, which is a glycyrrhizin-free isoflavone and chalcone, has been isolated from the root. In addition, licochalcone A, an oxygenated chalcone, and an immunosuppressant substance called LX were also isolated from the plant.



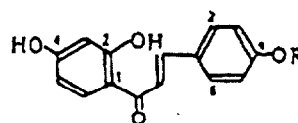
Glycyrrhizic acid
R = glycyrrhetic acid



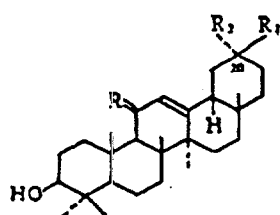
18 β-Glycyrrhetic acid



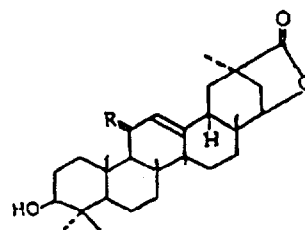
	R =	R ₁ =
Liquiritigenin	H	H
Liquiritin	H	-glucose
Neo-liquiritin	-glu.	H



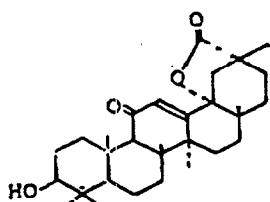
	R =
Isoliquiritigenin	H
Isoliquiritin	-glucose



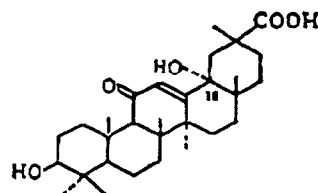
	R =	R ₁ =	R ₂ =
Acid I	H ₂	COOH	CH ₃
Liquiritic acid	O	CH ₃	COOH
Glycyrrhetol	O	CH ₂ OH	CH ₃



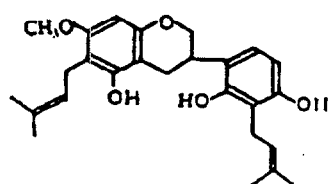
	R =
Glabrolide	O
Deoxyglabrolide	H ₂



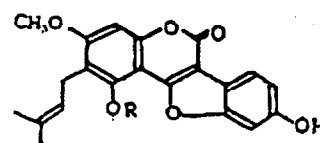
Isoglabrolide



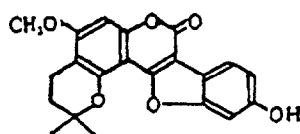
18α-Hydroxyglycyrrhetic acid



Licoricidin



	R =
Glycyrol	H
5-O-Methyl-glycyrol	CH ₃



Isoglycyrol

Actions:

Endocrine System — Licorice root possesses a steroid-like activity. Chronic administration of this herb produces symptoms of hypertension, transient reduction of kaliemia, increase of body weight, and depression of plasma renin activity.² There is an increase in the plasma levels of mineralocorticoid, which leads to a decrease in urinary Na⁺ excretion and an increase in urinary K⁺. An increase of plasma Na⁺ ion and retention of body fluid then results. In addition, blood Ca²⁺ decreases. Such effects were not observed in bilateral adrenalectomized animals or in dexamethasone-treated rats.

Licorice can potentiate and prolong the action of cortisol and increase the urinary excretion of 17-ketosterone. It inhibits the release of melanin-stimulating hormone from the pituitary. It causes a fall in vitamin C levels in the adrenal gland and an increase in adrenal weight. It also causes a decrease in eosinophil and leukocyte counts.

It is known that glycyrrhizin, the active principle of the herb, is a potent inhibitor of 11- β -hydroxysteroid dehydrogenase (11- β -OHD) in man. This enzyme plays an important role in conversion of aldosterone into inactive steroid. Thus, the inhibition of 11- β -OHD by licorice results in a pseudohyperaldosteronism. Hypertension is observed, which can be reduced by spironolactone.¹⁴ This hypertensive effect may be partially mediated through the CNS.⁸

Hypokalemic myopathy and rhabdomyolysis have also been observed in chronic ingestion of this herb. Elderly persons susceptible to the effect of licorice may show a rapid deterioration of renal functions.¹⁰

Anti-Inflammation and the Immune System — Licorice and glycyrrhizin also inhibit the conversion of cortisol to cortisone in the kidney by inhibition of renal 11- β -OHD. The urinary cortisone excretion is down and the plasma level of cortisol is up. This exerts an anti-inflammatory effect and can counteract the activity of burn-associated suppressor T cell activity.

Licorice can reduce hypersensitivity reactions and capillary permeability. In addition, it can prolong the survival time of transplanted tissue and inhibit the production of antibodies. The active principle responsible for this effect belongs to the heat-stable LX immunosuppressant.

The herb is a promotor that modulates the proliferation and IL-2 production of murine thymocytes in response to anti-CD3 monoclonal antibody.⁸ The herb selectively activates extrathymic T cells in the liver, but does not affect regular T cells in the thymus.¹⁵

The water-based extract of licorice can increase proliferation of human fibroblasts. This is attributed mainly to the glycoside of this herb, isoliquiritin, which can inhibit granuloma angiogenesis and shows an antigranulomatosis effect.^{16,20}

Digestive System — *Gan Cao* has remarkable antigastric ulcer activity. It inhibits gastric secretion and ulcer formation. This activity is due to the FM 100 fraction, which can lower gastric acidity and reduce pepsin activity and inhibit gastric secretion. The FM 100 fraction is a potent inhibitor of 15-hydroxyprostaglandin dehydrogenase (15-OHPGD) and δ -13-prostaglandin reductase. These enzymes play an role in regulating the PGE₂ and PGF_{2 α} level in the human body. Inhibition of the enzymes by the FM 100 fraction would raise the local concentration of

PGE, which in turn promotes mucous secretion and cell proliferation in the stomach, leading to healing process of the ulcer.¹

Licorice and glycyrrhizin are widely used in patients with chronic liver diseases. They have a protective effect against CCl_4 hepatotoxicity and can reduce cisplatin-induced hepatotoxicity, nephrotoxicity, and reticulotoxicity without affecting its anticancer efficacy.^{31,34}

The Japanese used licorice to treat chronic hepatitis B infection. Patients taking this herb show an improvement of liver function, with occasional complete recovery from hepatitis. It is been shown that glycyrrhizin can suppress the reaction of hepatitis B surface antigen (HBsAg).²⁶

Other Effects — The herb is a potent antitoxin. The classic Chinese medical texts stated that "*Gan Cao* can detoxify hundreds of toxic substances...." Experiments showed that glycyrrhinic acid can lower the toxicity of strychnine, histamine, chloral hydrate, arsenate, snake venom, diphtheria toxin, tetanus toxin, etc. In isolated perfused heart experiments, *Gan Cao* can antagonize the actions of physostigmine and acetylcholine.

It was claimed that *Gan Cao*, through its glycyrrhinic acid and water hydrolysis products, can transform several toxins in the liver into insoluble products.

In small doses, the herb stimulates biosynthesis of cholesterol in rat liver and can lower the plasma levels of cholesterol and triglycerol in hypertensive patients by increasing excretion. It can have a preventive effect on arteriosclerosis formation.

Gan Cao is an effective antitussive and expectorant. Oral administration of *Gan Cao* can reduce inflammation of the laryngeal mucosa and exert a protective action to reduce irritation. 18- β -Glycyrrhetic acid definitely has an antitussive effect, acting both locally and centrally.

In addition, the herb has analgesic and anticonvulsive effects.

Glycyrrhizin inhibits Na/K ATPase and exhibits a significant antioxidant, anti-tumor, and antimutagenic activity.^{7,43} When it is given to animals in combination with saikosaponin, the herb can reduce mutagenicity of mutagen AFB₂ in the animal and produces a chemopreventive effect.

Licochalcone A inhibits the growth of both *Leishmania major* and *L. donovani* promastigotes and amastigotes. It is also found to inhibit the human malaria parasite, *Plasmodium falciparum*.²¹

Abuse or chronic use of *Gan Cao* can result in hypertension, similar to Cushing's syndrome. A regular daily intake of 100 mg glycyrrhizin (approximately corresponding to 50 g licorice root) would be enough to produce such a hyperaldosteronism effect. The herb also has a tendency to lower the basal metabolic rate and decrease thyroid function.

Pharmacokinetic — Glycyrrhizin is binding with human serum albumin and can competitively be displaced by ibuprofen, warfarin, salicylate, or deoxycholic acid.¹³

The herb is absorbed readily from the intestine and is generally metabolized in glucuronate form in the liver. Only 1% of the dose taken is excreted in the urine.

The half-life ($t_{1/2}$) of 18- β -glycyrrhetic acid in the human is 11.5 ± 1.2 h. In patients suffering with chronic hepatitis, the half-life of this agent is prolonged to 6 h.¹⁸

Therapeutic Uses: Chinese medical texts describe *Gan Cao* as an agent to "improve the tone of the 'middle *jiao*' (the digestive system) and replenish *qi*, to remove 'heat' and toxic substance, to moisturize the lungs and arrest coughing, and to relieve spasms and pain."

Licorice root candy is a favorite snack for children. It is also used in many food or drug preparations as a flavoring adjuvant, an ingredient in cigarette or chewing tobacco for its taste and property to reduce irritation. Alexander the Great distributed the root to his soldiers to alleviate thirst.

Gan Cao is effective in the treatment of mild or moderate cases of hypocortecosteroidism or Addison's disease. It can be used alone or in combination with cortisol to produce a synergistic effect.

Licorice pills are sold in overseas Chinese stores as an antigastric ulcer product.

The herb is also used to treat bronchitis, tuberculosis, and peptic ulcers. It is administered in doses of 30 g, decocted and taken twice a day in the treatment of thrombocytopenia purpurea. In addition, it is used as an adjuvant to other herbs, to smooth their taste and reduce their side effects.

Glycyrrhizin and IFN- α are synergistic in antiviral action against hepatitis A virus (HAV).³ Therapeutically it is also found to be effective in the treatment of interferon-resistant chronic hepatitis C infection.²²

The herb is used as an adjuvant in the treatment of organophosphorous pesticide poisoning and in preventing the complications.¹¹

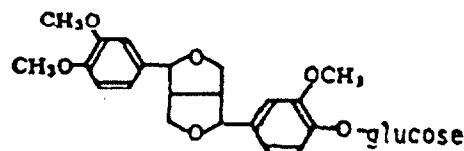
In combination with spironolactone, this herb is effective in treating hirsutism.⁹

There are many formulas in which *Gan Cao* serves as the principal adjuvant, or supporting herb. Standard preparations include a *Gan Cao* extract, which is administered in doses of 5 to 15 ml t.i.d. In tablet form, the herb is administered in doses of 3 to 4 tablets t.i.d. The drug biogastrone contains glycyrrhetic acid (50 mg/tablet); it is taken in doses of 2 tablets t.i.d.

LIAN QIAO (連翹)

The dried fruit of *Forsythia suspensa* (Thunb.) Vahl.

Chemistry: The fruit contains forsythol ($C_{15}H_{18}O_7$), phillyroside ($C_{27}H_{34}O_{11}$), oleo-anolic acid, and rutoside.



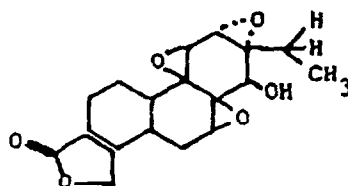
Phillyrin or Phillyroside

Actions: The herb has antibacterial action against *Salmonella typhi*, cholera, *E. coli*, diphtheria, plague, tuberculosis, staphylococci, and pneumococci. It has anti-inflammatory properties and can lower body temperature. It can increase body immunity. It protects hepatic function and is an effective cholagogue. In the cardiovascular system, it can produce vasodilatation and a hypotensive effect. It is a diuretic and antiemetic; the latter effect occurs via inhibition of the chemoreceptor trigger zone (CTZ).

Therapeutic Uses: In the treatment of early influenza and cold, the herb is administered in doses of 9 to 16 g prepared in a decoction. It is also used in the treatment of encephalitis, hepatitis, carbuncle, and tuberculosis.

TRIPTOLIDE (雷公藤素)

A diterpenoid trioxide isolated from *Tripterygium wilfordii* Hook.
(See Chapter 29 and Chapter 43.)



Triptolide

Actions: Triptolide is one of the active nonalkaloid principles isolated from *Tripterygium* and possesses an extensive suppressive effect on immune function, especially on T and B lymphocytes. The inhibitory effect is direct and nonselective. It inhibits IL-2 production and IL-2R (receptor) expression by interfering with signal transduction of IL-2.^{3,16, 24}

Figure 3.1 illustrates the effect of triptolide and triptdiolide on IL-2 production of T-cells.

At high doses, it exerts an anti-inflammatory effect by stimulating the pituitary-adrenal axis with little effect on PGE content of the inflammatory tissues.³⁰

Clinical trials show that it significantly inhibits the proliferation of peripheral blood mononuclear cells of rheumatic arthritis patients.²⁵ After medication, patients usually indicate that their stiffness, walking, and hand grasping strength are improved and their inflammation index goes down.³⁰

Triptolide can synergize the pharmacological effect of other immunosuppressing agents, especially cyclosporine.

Toxicity: Triptolide is quite toxic. A dog or rat receiving a dose of triptolide of 10 mg/kg/d would show significant toxic symptoms, including a high blood urea level and damage to the heart, liver, and kidney. This is usually reversible when administration stops.

Approximately 28% of the patients taking this compound show some types of side effects, such as gastrointestinal disturbance, nausea and vomiting, ulceration of mouth mucosa, anemia, hypotension, and edema. Long-term therapy may cause mental fatigue and agranulocytic anemia.

Therapeutic Uses: This agent has a potential therapeutic effect on some types of solid tumors, including breast and stomach carcinoma.²¹ It is also used in the treatment of SLE nephritis patients at a dose of 30 mg/d, resulting in a significant lowering of CD8⁺VV⁺ cell level.²⁸

Because of its synergistic effect with cyclosporine, it is recommended to be used together with cyclosporine in allograft organ transplant, aiming to reduce the toxicity and resistance development of cyclosporine.

Siegesbeckia orientalis L.

NAMES: Pinyin: xī xiān.

English: divine herb.

USES: *Root*: Analgesic, antirheumatic, used externally for abscesses, boils and ulcers. *Plant*: Whole plant used for arthritis, bad back, boils, dermatitis, hemiplegia, hypertension, leg ache, rheumatism, side ache, sciatica, weak knees. Ground and taken alone or with *Acanthopanax* (or *Periploca*), *Clerodendron* and *Xanthium*, for convulsions, paralytic stroke, and rheumatoid arthritis. For bugbites, dog bites, malaria, numbness, snakebites, tiger bites, and ulcers. Decocted for malignant tumors, mentioned as a tumor remedy in the T'ang Pent'sao (659 AD).



腺梗稀荃

5321 稀荃 xī xiān
(《唐本草》)

Ref: 4, 12, 15, 16, 35, 36, 37.

CHEM.: The root contains essential oil, a white substance suggesting salicylic acid, and a bitter glucoside (darutoside, $C_{26}H_{44}O_8$) which on hydrolysis yields an aglucone, darutigenol and on acid hydrolysis yields a mixture of aglucones and isodarutigenals B and C. Extracts are said to have antiviral, hypoglycemic and insecticidal activities. The fresh juice, dressed over a wound, leaves a varnish-like coating as it dries.

Colx lacryma-jobi L.

NAMES: Pinyin: yì yī rén.

English: Job's tears, pearl barley.

USES: Decoction believed to benefit the blood and breath, used for washing the newly borne to prevent disease. *Fruit*: Used for intestinal or lung cancers and warts. Wine made from fermented grains given in rheumatism. Vermifuge; for gonorrhea, hypertension. *Seed*: Antirheumatic, diuretic, refrigerant; decoction for appendicitis, arthritis, beri-beri, bronchitis, cancer, diarrhea, dry skin, dysuria, edema, hydrothorax, inflammation, pleurisy, pneumonia, pulmonary abscess, rheumatism, and tuberculosis. *Plant*: Anticancer.

Ref: 4, 12, 15, 25, 33, 35, 37, 68.

CHEM.: Per 100 g, the seed is reported to contain 380 calories, 11.2 g H_2O , 15.4 g protein, 6.2 g fat, 65.3 g total carbohydrate, 0.8 g fiber, 1.9 g ash, 25 mg Ca, 435 mg P, 5.0 mg Fe, 0 mg beta-carotene equivalent, 0.28 mg thiamine, 0.19 mg riboflavin, 4.3 mg niacin, and 0 mg ascorbic acid. There is 50-60% starch, 18.7% proteins (with glutamic-acid, leucine, tyrosine, arginine, histidine, and lysine) and 5-10% fatty oil with glycerides of myristic- and palmitic-acids. The herbage (ZMB) contains 8.5% protein, 2.8% fat, 79.8% total carbohydrate, 27.9% fiber, and 8.9% ash.



1. 植株上部 2. 颖小穗
3. 颖壳及退化的雄蕊

5548 薏苡仁 yì yī rén
(禾本科)

Cymbopogon
NAMES:

English: citronella

USES: L

inal pain, pain, and

CHEM.: reported to

H_2O , 1.0 total carb

ash, 32 mg

425 ug bet mg thian

mg niacin Contains:

0.4% yield cymbopog

ral (65 to nent. Alk

dipentene, dihydrop

(linalool, terpineol,

citronello (citronellal,

volatile ac caprylic, cit

Cynodon dactylon
NAMES: P

English: Bermuda grass

USES: Root purative, di

lirium, stomachic

Plant: Decoction of rice loss from pa

for menorrhagia

CHEM.: Contains anticancer compounds